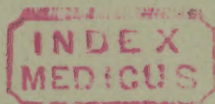


White (Jos. A.)

THE  
OPHTHALMOSCOPE

AS A



DIAGNOSTIC MEANS

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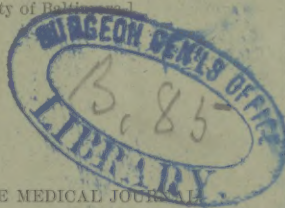
VARIOUS FORMS OF DISEASE.

BY

JOSEPH A. WHITE, A. M., M. D.,

Late Professor of Eye and Ear Diseases in the Washington University Medical College. [A

Paper read before the Medical and Surgical Society of Baltimore.]



FROM DECEMBER NO. RICHMOND AND LOUISVILLE MEDICAL JOURNAL.

COMPLIMENTS OF

**Dr. Joseph A. White,**

Late Prof. of Eye and Ear Diseases in Washington University of Balto.

PRACTICE LIMITED EXCLUSIVELY TO DISEASES OF THE EYE AND EAR.

158 N. HOWARD ST., OPPOSITE ACADEMY OF MUSIC.

BALTIMORE.



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## THE OPHTHALMOSCOPE, ETC.

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Mr. President and Gentlemen,—You are all aware that for some years past the ophthalmoscope has been making a place for itself outside of its limited range in detecting diseases of the fundus oculi only. In this respect you know of the wonderful change the discovery of this instrument wrought in ophthalmic medicine, and it is needless to more than simply refer to its perfection as a diagnostic means in diseases of the retina and optic nerve.

But as the knowledge of its uses and application became more advanced and extended, connections were traced between these ophthalmoscopic changes and different constitutional diseases, and an almost entirely new field of research was opened up in which its use as a means of diagnosis of different diseases, and especially in troubles of the nervous system, was clearly demonstrated. In the investigation of these latter affections the ophthalmoscope is of such incalculable advantage that every physician who wishes to speak with authority on this point must know the ophthalmoscopic appearances in every case and in every phase and change of the disease. All physicians could very easily become acquainted with its use; and although those in large practice might be deterred from attempting this from an idea that it requires long practice and much study to do so, they would find on trial that it is comparatively easy, and the absorbing interest of the study makes it a pleasant one. It is true that it requires constant work to acquire sufficient proficiency with the instrument to diagnose the exact degrees of "errors of refraction," but this amount of skill is not necessary to obtain merely the details of the fundus oculi, which is all a general practitioner need know to aid him in diagnosing certain troubles. He would find that he could do this with sufficient accuracy in a short time.

Its use has become much more general abroad than in this

country, because the course of medical studies is here so short that the medical student hardly finds time to accumulate a sufficient amount of medical and surgical knowledge to pass the superficial examination he must undergo. His time is so occupied that he has no leisure to investigate the uses of such instruments as the ophthalmoscope, however valuable such knowledge may be to him in his professional career. That it is of undoubted and in some instances of invaluable assistance, I hope to be able to demonstrate.

Here allow me to say that in this paper I make no pretence to originality or discovery, but am only an humble follower in the footsteps of more worthy investigators, to whose researches I am mainly indebted for the material herein contained, submitting side by side with the results of this experience whatever examinations I have made myself. That signs of changes in the nervous apparatus were to be found in the eye was known long ago. Such symptoms as double vision, intolerance of light, the so-called amaurosis, contraction and dilatation of the pupils, paresis and paralysis of the motor muscles of the eyeball and eyelids, have all, long ago, been observed in connection with cerebral disease. But the discovery of the ophthalmoscope enabled us to trace the connection between eye symptoms and intra-cranial disorders still more accurately. We are indebted to Helmholtz for the discovery of the eye mirror, which he first described in 1857; but it is to Sichel and Von Graefe that our thanks are due for drawing attention to the great importance of studying the morbid changes of the optic disk and retinal vessels in connection with other diseases. Graefe first published an essay on this subject in 1860, and since then there have been many earnest workers in the same field of observation.

That changes take place in the *optic nerve* in cases of intra-cranial troubles oftener than in any other nerve of special sense, is a fact that does not need demonstration, and is, no doubt, attributable to its greater vascularity, its large share of connective tissue, and to its extensive connections with the base of the encephalon. That these changes take place much oftener and in a much larger percentage of cases than we have any record of, I do not doubt; and if physicians and ophthalmic surgeons



would work more in unison, if consultation could be had between them in all cases of optic-nerve trouble and those of intra-cranial and spinal disorders, the intimate connection between changes in the fundus oculi and symptoms of nervous disorders would be established in nearly every case.

The patients now go to the physician or the ophthalmic surgeon, according as the nervous or eye symptoms predominate, and in both instances the other train of symptoms may escape notice. On the one hand, the nervous disorder may not be observed by the ophthalmic surgeon; on the other, the eye symptoms may not be noticed by the physician. That we can have marked alteration on the optic disk and retina from simple congestion up to true neuritis without interfering with vision, is a fact already proven beyond question, and this explains how easily such conditions can be overlooked by both patient and physician.

But the ophthalmoscope is not only of great value in intra-cranial and spinal disorders; it has also been discovered to be of use in the diagnosis of diseases of the heart, sclerosis of the arteries, in hæmorrhagic diathesis, in leukæmia, in lead poisoning, in renal disease, in syphilis, etc.

I do not propose to enter into a description of the various forms of the ophthalmoscope, for you are more or less familiar with them; nor go into details of the anatomy of the optic nerve and retina, except in as far as may be needful for a right understanding of our subject. I will simply give you the healthy condition of the fundus oculi as a standard of comparison for the pathological changes I shall refer to. The ophthalmoscope I generally use, and the best and most complete that is made is Landolt's metrical ophthalmoscope, which has two mirrors, a two and four-inch object lens, and the whole series of spherical lenses, concave and convex, and a stenopaic plate. All that is required, however, for general use is a small concave mirror of about twelve-inch focus with a very small central perforation, and with a clip at the back for holding a correcting lens when needed; besides this a two and a four-inch convex lens for the indirect or actual image will complete the outfit.

When we first look at an eye through the mirror we find the

reflection of the light from the fundus gives us a red instead of a black pupil, and out of this red expanse we can very shortly learn to define the optic disk and retinal vessels. The general aspect of the disk is circular, or slightly oval with the long diameter vertical. The color is a compound one, made up of red from the nutrient capillaries; white from its connective tissue, and yellowish-gray from the nerve tubules, the whole producing a cream color warmed by a pink tinge. This varies slightly in different subjects; some disks being higher colored than others, just as some faces are. The inner half is always more decidedly tinted than the outer half, and the whitest part is the centre, where a bundle of connective tissue surrounds the central vessels. Here the surface is sometimes depressed, forming what is known as the physiological pit. The circumference is generally a zone of white from the sclerotic surrounding the disk with a brownish-gray, or decidedly pigmented outer boundary from the choroid.

The *vessels* of the disk itself are almost invisible, save a few small twigs which pierce the disk, and sometimes radiate on to the retina. The vessels we see ramifying over the fundus oculi are the central artery of the retina and its accompanying veins. The artery pierces the disk near its centre and divides into an upward and downward branch, which, by repeated bifurcations, spreads over the whole retina, except the yellow spot. The corresponding veins enter the disk separately, sometimes two to each artery, are larger and darker than the arteries and more tortuous in their course. Sometimes they have a spontaneous pulsation near their entrance into the nerve, and nearly always this will follow on a slight pressure of the eyeball. (Donders.) The vessels all look like red tubes with shining, bright centres and darkened edges. In the arteries this central streak is more marked than the veins, because they are more cylindrical. The retinal arteries are derived from the ophthalmic artery, and the veins empty into the cavernous sinus through the ophthalmic vein. The peculiarity of the retinal circulation is that there is no pulsation in the arteries as there is in the general circulation; and, strange to say, the action of the heart can be often increased till violent palpitation at the chest and throbbing at



the temples ensue without affecting the retinal circulation. (Loring.)

"No doubt," says Loring, "this is due to the regulating power of the intra-ocular pressure dependent on the watery or gelatinous contents of the globe and its more or less elastic membranes," though I do not see how he explains the fact that if this pressure is still greater, as in glaucoma, arterial pulsation results. On the other hand, according to Stellwag, if this normal pressure is relaxed by piercing or removing part of the membrane of the eye the same results follow, viz., pulsation of the arteries. Loring also suggests that from the very same cause, because of a compensating pressure which maintains a given equilibrium throughout the medium of the soft substance of the brain and the cerebro-spinal fluid, the arteries of the brain no doubt follow the same rule as those of the retina, and do not pulsate in a normal state. In an abnormal condition the arteries of the retina often pulsate, and so may those of the brain. But this retinal circulation has not the intimate connection with the cerebral circulation that the nutrient vessels of the optic nerves have. These nerves arise chiefly from the corpora quadrigemina, the true centres of vision, taking a few fibres from the optic thalami, cross the crura cerebri, take fibres from the geniculate bodies, then become almost cylindrical and run along the base of the brain to the chiasma or optic commissure, where decussation of their fibres takes place before they branch off to each optic foramen.

The whole of the optic tract is mainly invested by the pia mater, which gives off nutrient vessels to it; in addition, its nutrition depends, according to Galazowski, whose observations have been corroborated by others, upon, 1st. An arterial branch entering at the post border of the testes, called the post-optic artery. 2d. Four vessels, two arteries and two veins, which enter the optic tracts at the post border of the cerebral peduncles coming from the choroid plexus of the third ventricle, called the middle optic arteries. 3d. A large branch from the middle cerebral artery, the anterior optic artery; and 4th. Filiform branches from the pia mater to the chiasma.

Now, all these branches form a network which extends from

the tracts to the disk and give the rosy tint to the latter, and you can easily see that this is purely a cerebral vascularity independent of the ophthalmic artery. The situation of the nerves also shows you how easily they may be affected by any intra-cranial trouble, especially at the base of the brain. As the nerve enters the eye it passes through the sclerotic, which forms an unyielding ring, slightly constricting the nerve; and the relation of this ring to the nerve, in certain pathological conditions, is of great importance. The nerve is invested by an inner sheath continuous with the pia mater, and by an outer sheath continuous with the sclerotic on the one hand, and the dura mater on the other, though differing in texture from both of them (Sappey), leaving between the two sheaths a space, the sub-vaginal space (Schwalbe), the continuation, as it were, of the intermeningitic cavity of the brain.

I have no time to go into the few anomalies of the fundus oculi to be sometimes met with in a perfect state of health, as I have already taken up too much time in explaining the healthy appearances and the cerebral connections of the optic nerve and retina; and I will now pass on to the consideration of the pathological changes to be met with in the eye in connection with disease in other organs.

These deviations from a healthy condition are to be divided into the changes which occur in the circulation only without any alteration of structure, and those congestions with effusion, neuritis, and atrophy.

In making our examination we have to watch the optic disk, the retina, the choroid, and the blood vessels. Each of these parts is subject to various alterations, into the minute description of which you will not expect me to enter, as some of them have no bearing on the subject at issue.

The principal changes with which we have to deal in this connection are hyperæmia, active and passive, anæmia, œdema of the disk, the engorged disk, which Dr. Albutt calls ischæmia, true neuritis with perineuritis, which I have never seen except in connection with neuritis itself, neuro-retinitis, retinitis, consecutive and primary atrophy.

*Hyperæmia, Etc.*—With regard to active and passive, or



arterial and venous hyperæmia of the disk or retina, or of both, we must be very careful not to confound them with healthy appearances. We must know how to discriminate in different cases, as the same condition in one may be physiological whilst in another it would be pathological. We must take into consideration the age of the patient, his complexion, the color of his hair and eyes, and the uses to which the latter are subjected, all of which will have more or less bearing upon the coloring and vascularity of the disk and retina.

In health, moreover, we nearly always find both eyes alike, whilst in the hyperæmic and anæmic condition there is usually a difference between the two eyes, the difference being greater or less according to the cause of the trouble. It will be always more or less difficult to determine the lesser degrees of hyperæmia or the very beginning of anæmia, where there is exactly the same change in each eye; but it is a great help if, as is generally the case, we find the change more advanced in one than in the other.

In arterial or active hyperæmia of the fundus oculi we find the disk much more flushed than normal, sometimes uniformly red and its outline slightly clouded, whilst the retinal arteries are enlarged and full, with the smaller branches more numerous and pronounced, especially near the yellow spot. In the passive form, venous hyperæmia, the disk is not so much flushed and red, whilst the retinal veins are abnormally large, dark and tortuous; and if it has lasted some time, we may have an œdematous swelling of the retina just around the disk and along the larger veins. This form is frequently present in states of venous congestion dependent upon disturbances in the general circulation; or, it may be due to any local cause preventing return of blood from the retinal veins.

Anæmia of the disk and retina is the opposite of hyperæmia, depending upon emptiness of the blood vessels; but we must be careful to distinguish this condition from commencing atrophy or pallor of the disk. Anæmia of the disk is always accompanied by anæmia of the retina and choroid, and such eyes light up very badly, whilst in commencing atrophy the choroid is of normal tint. The vessels in anæmia are shrunken and not



so sharply defined, although we can still distinguish the arteries from the veins; but in atrophy, although this latter distinction is commonly lost, the vessels stand out sharply defined against the white disk. Moreover, in atrophy the edges of the disk are sharp and staring, as it were, whilst in anæmia the general pallor of the fundus makes the disk less distinct, and sometimes a slight cedema clouds its edge still more. In addition, the subjective symptoms are different. In atrophy the field of vision nearly always contracts from the inner side, and in anæmia there is general feebleness of vision; in atrophy we have the history of a gradually-increasing amblyopia with scotomata or black spots in the field, whilst in anæmia we have sudden fits of blindness with flashes of light; e. g., on rising from bed, relieved by intervals of almost perfect vision.

The causes of anæmia are the same as those of general or local anæmia. Dr. Fothergill, in speaking of "cerebral anæmia," says that pallor of the eye is of more diagnostic value than the condition of the skin. He says "the condition of the eye tells of the vascular condition of the encephalon, the blood supply of each being derived from a common source. In cerebral anæmia we have retinal anæmia, with pale optic disks and dull choroid tint. This is a uniform pallor, not a whiteness of one part and a vascularity of another. In the latter case we do not deal with cerebral anæmia."

Cedema of the disk is not often seen as a distinct disorder, but is most frequently the complement of other affections; of neuritis, of embolism of the central artery, of anæmia, etc. Macnamara reports a case where cedema existed without any other change in the fundus oculi in a patient paralyzed in all four limbs; and from the condition of the disk he concluded that there was also a serous effusion without structural lesion in the centres of motion, and the result of treatment conducted upon this diagnosis justified his assumption.

*Ischemia and Neuritis.*—The most marked changes in the optic disk occur in true optic neuritis and engorged disk, which for a long time were confounded as one and the same thing, dependent upon inflammation of the nerve. But Grafe pointed out the difference between the two; the one, ischemia or en-

gorged disk, being dependent upon vascular arrest alone; the other upon true inflammation of the nerve fibres.

In the former we have trouble only at the disk, the trunk of the nerve being unchanged; in the latter we have a pathological condition of the nerve trunk as well as of its terminal end. In ischaemia the condition of the disk is due in most cases to obstruction in the cavernous sinus or ophthalmic vein, causing slight venous arrest and consequent swelling in the trunk of the nerve, which is then, as a result of the swelling, strangulated by the unyielding sclerotic ring, which embraces it at its entrance into the eye. Graefe shows that this strangulation of the ring is a necessary adjunct in producing this condition, as pressure on the cavernous sinus alone would not be a sufficient cause.

In neuritis the pathological change is due to inflammation of the nerve trunk which descends to the disk; hence it is called "descending neuritis." The active agent in this inflammation is probably the connective tissue implicating the nervous elements and producing secondary vascular changes. Sometimes neuritis is complicated with or preceded by ischaemia, so that a differential diagnosis becomes impossible. The appearances of the two are as follows: In ischaemia the disk is swollen and projects forward, rising higher on one side and sloping down nearly to the level of retina on the other, being inclined or tilted to one side, as it were. Its outline is blurred or entirely concealed by a halo due to infiltration and excessive vascularity, which involves the retina immediately around the disk, but not to a great extent. Its color is sometimes a dirty gray and red mixed, when there is much passive effusion and capillary hæmorrhage; sometimes it is of a bright polished, moist appearance. Dr. Albutt applies the term "mossy" to ischaemia in contradistinction to "woolly" which is used in connection with neuritis. The veins become very much enlarged and almost varicose, with a tortuous course knuckling over the edge of the disk.

It is astonishing how great this change may be and how long it can exist without disturbing vision in the least. In neuritis the nerve is swollen, but not so much as in ischaemia, and does not show the steep elevation of one side as in the latter.

In ischæmia we have the minute branches and capillaries coming into view, but not so abundant, and we also have minute hæmorrhage on and near the disk. The distention of the large trunks is more marked than in ischæmia, and the color is different. It is more of a bright gray with a reddish tinge, and the exudation is more uniform and opaque, with marked striated outline extending farther on to the retina and involving more of its tissue. Light is generally more or less affected.

The causes of ischæmia (intra-cranial causes I mean) are whatever directly or indirectly distend the ophthalmic vein, the slightest distention being made manifest by the "multiplying action" of the sclerotic ring. The three principal causes are meningitis, hydrocephalus, and tumors. Neuritis is due principally to meningitis or encephalitis, viewed as a symptom of head trouble; in this connection depending upon inflammation of some encephalic tissue, most commonly of the membranes. A chronic meningitis near the base of the skull is very certain to set up optic neuritis. Optic neuritis sometimes is due to the presence of tumor, but according to Albutt and Hughlings Jackson it is possibly because of a meningitis or cerebritis surrounding the tumor and extending along the optic tracts or nerves.

Sclerosis, hæmorrhage and softenings of every kind never produce either, engorged disk or neuritis, and abscess very rarely and only when it has continued for a long time. These are generally followed by simple progressive atrophy.

Now this simple progress in atrophy is sometimes preceded by a hyperæmic stage, the stage of "red softening," or, as some call it, chronic neuritis, first described by Mr. Jonathan Hutchinson in speaking of tobacco amaurosis. The disk is too red, sometimes with slightly blurred outline, and the choroid is full of blood. This soon changes, and the disk becomes too white, the arteries being lessened in calibre until at last all traces of the arteries disappear, and the disk is very white. We divide atrophy into primary and consecutive; primary when not preceded by neuritis or choked disk, consecutive when it follows upon these appearances. Galazowski, H. Jackson and others



have endeavored to point out distinctive characteristics for each, but they are of no importance, as both forms generally end in the sharply-defined white disk with shrunken vessels. In primary atrophy this definition of outline continues throughout, but the consecutive form is at first ragged and uneven. Sometimes we see a bluish slaty disk or bluish gray oftenest in connection with sclerosis, locomotor ataxy for example, and other spinal troubles, as also in the amaurosis of lead poisoning.

Now having examined such appearances of the fundus oculi as are known to result from intra-cranial disorders, are we to conclude that degeneration of the optic nerve always means intra-cranial disease?

I should say by no means, for this is not at all a demonstrated fact; but where we find choked disks, optic neuritis or commencing atrophy, and have no extra-cranial cause for them, we should regard them as very serious lesions, suggesting intra-cranial trouble, and necessitating great watchfulness. Moreover, we will not often be called upon to decide from these symptoms alone, but will have other manifestations to guide us.

*Meningitis.*—What is the value of the ophthalmoscope in this disorder? If we examine the reports of Dr. Albutt and Dr. Hughlings Jackson and Bouchut on this point, we will at once conclude that it is of great diagnostic value. This disease has various origins and different names, the most important being tubercular meningitis, found at all ages, but most common in children; from its seat, etc., it is sometimes called granular basilar meningitis.

It is generally considered a fatal disease, because in the experience of the profession at large nearly every case that presents well-marked symptoms of the disorder die. Where recovery has taken place, one usually concludes that a mistake in diagnosis has occurred. The results of the investigation above mentioned show that exactly the same neuro-retinitis takes place in the eye in cases that die and cases that get well—both with same train of symptoms. We have in both the ischæmia or choked disk, or neuritis or both; the former due to the general intra-cranial pressure obstructing venous return; the latter to extension of the inflammatory process along the pia mater enveloping the

nerve. In the cases that got well the vomiting, fever, convulsive movements, etc.; in other words, the head symptoms were not so pronounced, but the eye changes were the same, and are consequently of great aid in the diagnosis of doubtful cases. One case reported by Albutt, which recovered and afterwards died from a second attack, showed the post-mortem traces of an old tubercular meningitis, and a recent one. Still the absence of changes in the disk will not exclude meningitis, as they are absent in a small percentage of cases. Some of the results of tubercular meningitis in the cases that recover are idiocy and blindness, and sometimes deafness.

In syphilitic meningitis we nearly always have true "neuritis descendens," and this ophthalmoscopic sign is of great value.

In other forms of meningitis, e. g., in erysipelas, fevers, pyæmia, etc., it will also be of service to distinguish true meningitis from delirium caused by the action of the morbid blood on the brain.

In recent hæmorrhage the ophthalmoscope is of no value, at least of no great value, judging by the reports we have on this subject. It is true that neuritis can occur from an old clot acting in its capacity as a foreign body, just as syphilitic changes in the brain produce the same result, not because they are syphilitic in character, but only because they are foreign bodies; or a clot can excite optic-nerve trouble by setting up a meningitis. Apoplexy produces no change in the retina, although frequent ecchymosis in the conjunctiva or retina are of prognostic value in indicating impending apoplexy. Miliary aneurisms of the brain, which often are the cause of hæmorrhage, according to Lionville, can be diagnosed from the condition of the retina.

Softening of parts of the encéphalon gives us no significant changes in the eye unless the disease involves the centre of vision, when atrophy would result. Abscess has never been recorded to produce change in the optic disk, but an encysted abscess might, by pressure on the central parts of vision, cause atrophy. Sclerosis generally produces atrophy of the disk, for it is found in general paresis, locomotor ataxy, and insular sclerosis or trembling palsy.

In locomotor ataxy the change in the disk may, and often does

precede the other symptoms by some months or even years. This atrophic change is characterized by a general limitation of the field of vision commencing at the periphery, and by a want of sensibility for the red and green rays, with a general aversion to bright light. In nearly all chronic forms of spinal disease we have changes in the eye, the higher the seat of disease the sooner the changes set in. We do not understand the causation of these changes, but some attempt to explain them by the action of the sympathetic, as they do everything about which they know nothing. It is the fashion to make the sympathetic shoulder and account for everything which can not be otherwise explained.

Hydrocephalus is very destructive to the optic nerve, causing atrophy, but except occasionally the eye symptom would not be of much use in a diagnostic point of view, as the other symptoms would, in most cases, precede the optic-nerve trouble. Sometimes, however, in children who seem "to take very little notice" of anything, the examination of the disks might guide us in determining commencing hydrocephalus.

In concussion from fracture the ophthalmoscope, up to this time, has not been found to be of much service in determining the extent of the intra-cranial lesion; but in speaking of intra-cranial tumors we enter a field that has been well investigated, and in which the many valuable data discovered by the use of this instrument have proved its importance as an aid to diagnosis in determining whether any coarse disease of the encephalon is present or not in doubtful cases, and if present, some idea of its situation. Its nature can not in any way be determined by the ophthalmoscope.

Dr. Hughlings Jackson (a physician and not a specialist) says that the ophthalmoscope is invaluable in the diagnostication of these tumors; that in his opinion optic nerve changes almost invariably precede or accompany the manifestation of other symptoms of intra-cranial coarse disease wherever located; the *time* of the appearance of eye trouble depending upon the *locality* of the adventitious product. We can not always account for the presence of these optic-nerve troubles, but they do occur. The nearer the location of the tumor is to the base



of the brain, the more frequently and the earlier the eye symptoms manifest themselves, and even in some cases precede all others except headache. These statements are confirmed by numberless autopsies verifying the diagnosis. Professor Foester, in his *Handbook of General Ophthalmology*, says that increased intra-cranial pressure from whatever cause is manifested by optic neuritis or choked disk; the former by direct or transmitted irritation of the optic nerve; the latter from distention of the subvaginal lymph spaces of the optic nerve by fluid compressing its vessels. In the former case vision is nearly always affected; in the latter the vision is not so often impaired. From this you can easily see how necessary is the routine use of the ophthalmoscope in suspected intra-cranial disease, as even if there be no amaurosis present, we may still have marked optic-nerve changes, and these changes are nearly always double or in both eyes. Next to hemiplegia, there is no more decisive evidence of intra-cranial tumor than this easily discoverable pathological condition. It enables us at once to decide whether the nervous symptoms depend on "organic" or "functional" disease ("coarse" or "minute" changes). We can not say positively that the absence of these signs negatives coarse disease of the brain, but when present, as they are in nearly every case, they are of unquestionable value.

Another consideration is, that if we use the ophthalmoscope constantly in these cases, we may often be enabled to prevent amaurosis or defective vision by prompt treatment of the early stages of neuritis. Those who wait for the defective sight to declare itself before looking at the optic nerves overlook the early remediable stages of neuritis, and they also overlook the optic changes altogether, as defective vision may not occur from first to last.

Whenever I have been consulted in such cases, I always find defective vision, because I am not consulted unless there is some amaurosis. But if, as I have frequently done, I go into a hospital ward and examine the optic disks of a case with head symptoms of doubtful diagnosis, I have found engorged disk, or neuritis without any defect of vision whatever. Again, I have had persons consult me with defective vision whose disks

led me, in the absence of every other cause, to the diagnosis of intra-cranial coarse disease. Some of them I lost sight of, but the subsequent history of others corroborated this diagnosis. In one, a sea captain, who died three years after I saw him, a tumor was found near the base of the brain. The gentleman who performed the post-mortem gave me no details beyond this. Another, a case of a lady who had a severe attack of double neuritis, and which I diagnosed from the history of the case as due to syphilitic deposit on the brain (in its capacity as a foreign body) died six months afterwards with every symptom of intra-cranial disease. I have a scanty report of various cases of this kind, which, of course, would not serve as data for statistics; and since I have wanted to give special attention to this subject in the last year or so, I have had very few opportunities of seeing such cases. In special practice they come before us but rarely, as in consequence of the head symptoms (vague though they may be) first showing themselves, the cases go to a physician; therefore I would ask the favor of seeing such cases when under the care of any of my friends here present.

Dr. Albutt sums up all the facts to be found relating to tumors in every part of the brain in his book on the ophthalmoscope, and concludes from these that this instrument is of the greatest value and importance in diagnosing such cases, and in some instances may determine the diagnosis. At the same time, he remarks that it is not of such value as to enable the practitioner to dispense with quick sense and very careful thought. With regard to locating the diseased derangements of the motility of the eye or the study of the field of vision, it will be of the greatest service in combination with the other symptoms. In examining the field of vision, the external half of the field may be defective (nasal hemiopia), a slow process caused by morbid process invading the centre of the chiasm; or we may have defect of the inner half (homonymous hemiopia) pointing to trouble between the chiasm and central origin. Derangement of motility of the eye, on account of producing double vision when there is the slightest perversion of function of one side as compared with the other, is a diagnostic symptom of the highest importance, and because of the definite anatomical relation

of the motor nerves to different parts of the encephalon. These, with other symptoms occurring in connection with adventitious products in different parts of the brain, help to localize the affection, as well as the early or late appearance of optic-nerve changes. (Albutt's synopsis.)

To sum up, then, we may say that engorged disk, neuritis, or primary atrophy, should always be regarded as a grave symptom, in all probability associated with intra-cranial disorders when we can not find the cause in the eye or orbit. Moreover, in suspicious headache or other vague symptoms pointing to intra-cranial disorder, the ophthalmoscope should be used. If we find *engorged disks*, it generally means some adventitious product causing pressure on venous sinuses. If double *neuritis*, it indicates caries, periostitis, or meningitis. If *atrophy*, it points most commonly to sclerotic process of some kind, but may come from pressure at the visual centres or to inflammation of the nerve anywhere in its course.

*Retinitis Albuminurica*.—Carter says: "Hundreds of cases are on record where the ophthalmoscopic examination led first to the suspicion of renal disease, and the examination of the urine afterwards showed the presence of albumen. This proves that the retinal changes very often take place in what is called the pre-albuminuric stage of Bright's disease, and therefore the systematic use of the ophthalmoscope should be advised on patients whose age and bodily condition render them liable to such degenerative changes as take place in renal disease. But as long as the ophthalmoscope is used only by the specialist, the early changes in their troubles and the lessons to be learned from them will be overlooked. I have on more than one occasion advised a patient to see his or her family physician, with a view of discovering any renal disease where it had been before unsuspected, my suspicions being aroused by the retinal appearances.

Sometimes the retina is not affected at all, and again it may be, as in a case reported by Dr. Jabez Hogg, that the retinal change may confirm the diagnosis of renal disease when no albumen or casts can be discovered in the urine even up to the time of death. In this case there were the whitish splotches from



the fatty deposits, and minute hæmorrhages involving a great part of the retina, with occasional convulsions and other symptoms of uræmic poisoning, which induced Dr. Hogg to diagnose renal disease, confirmed by the autopsy revealing granular kidney.

Graefe thought that the retinal change was always pathognomonic of Bright's disease, but some authors differ from him in this, as they claim that they are found in other morbid states of the blood. The idea that Bright's disease is a systemic instead of a local renal trouble would seem to be confirmed by the ocular phenomena.

*Epilepsy.*—I have examined twenty-five cases during the last year. In these the fundus oculi of eight was perfectly healthy; six had hyperæmia of the disks; five decided anæmia; two choked disks, both of whom were still in the stupor following the spasm; one true neuritis; one choroiditis, with shrunk vessels and atrophied spots; and two had one eye healthy and the other showing pallor of the disk. Here 33 per cent. were healthy, the others showing different changes in the optic disk; 20 per cent. anæmia, and 25 per cent. hyperæmia. The two who were examined immediately after the spasm showing slightly choked disks.

The number of cases is entirely too small to enable us to draw any conclusions of much value; but I would remark that, so far, my examination does not agree with what little I have read upon this subject.

Dr. Aldridge, of the West Riding Asylum, gives reports of five cases examined immediately after a spasm, and found very pale disks in all of them. The two I saw showed venous arrest and choking of the disk.

Dr. Clifford Albutt claims to be able to pick out epileptics from among a crowd of patients by the condition of the disk and retina; this condition being a marked hyperæmic state. I found hyperæmia in six cases out of twenty-five, and anæmia in five; two others showed anæmia of one disk and not of the other. Now, these results are so varying that it seems rather doubtful whether Dr. Albutt or any one else can distinguish an epileptic by the condition of the retina and disk. The cases

showing anæmia or pallor of the disk may have recently recovered from an attack, the generally-received opinion being that an epileptic spasm is due to cerebral anæmia, and it may be that when it is attributable to that cause the anæmic condition may continue some time after the spasm has passed off.

The causation of epilepsy is still, however, a subject of conjecture, and the ophthalmoscopic appearances would tend to show it was due to more than one cause, an opinion that is confirmed by the late experiments of Ferrier.

*General Paralysis.*—In this affection I have carefully examined twenty cases. The disease is a kind of cerebral sclerosis, which might be divided into three stages.

In the first stage we find congestion resulting in deposits of lymph and adhesions in and under the pia mater and cerebral structure of the anterior two-thirds of the brain.

In the second stage we still find congestion, and it is believed by many that the *arteries* of the cortical substance and pia mater are in a condition of tonic spasm, as it were. Atheroma of the arteries generally commences in this stage.

In the third stage we have degeneration and disorganization, softening, atrophy, atheroma, abscess, and hæmorrhage.

I have examined only twenty cases of general paresis, four of which were in the first stage, thirteen in the second, and three in the third. Three of the four in the first stage showed marked hyperæmia of the disk with cloudy margin. Of the thirteen in the second stage three had engorged disks, two simple hyperæmia, one with the right disk hyperæmic and the left very pale; two showed commencing atrophy, and five had healthy eyes. The three in the third stage had an atrophic condition of the optic nerve. Here I do not think there can be any doubt of the value of the ophthalmoscope as an aid in determining the condition of the patient. Nearly all the examinations gave results exactly in accordance with the condition of the brain as shown by frequent post-mortems; and in this respect my own investigations agree with nearly all others I have seen, except in some unimportant particulars. Some of the cases which I have reported as hyperæmic (so recorded at the time of the examination) should rather, I think, have been noted as "chronic neu-

ritis," a condition which frequently precedes atrophy, and is analogous to the red and white softening of the brain.

The value of the ophthalmoscope as a means of diagnosis would at once declare itself in a case of general paresis with excitement, when there is some difficulty in distinguishing the trouble from "anæmia," by giving us the changes in the disk, which would, in the majority, help us materially in forming an opinion.

*Mania.*—We divide mania into acute and chronic. Of the acute form I have examined thirty-three cases. Ten of these or nearly 30 per cent. showed no change in the optic disk. In the other twenty-three cases active arterial congestion was discovered in eleven cases, engorged disk in six, neuro-retinitis in two, due probably to some basilar meningitis (chronic); two showed large swollen disks very white and shining with very large and full vessels (one of these was examined during a paroxysm of acute insanity, and the other just after such an attack); one a dirty gray disk with shrunk arteries, and one choroidal atrophy. Here, again, I may say the number examined is too small to form any certain conclusions, but where the results agree so well, i. e., in nearly 70 per cent. of the cases, with the known condition of the brain, viz., a state of high arterial congestion, it appears to me that the ophthalmoscope is likely to prove very valuable as an aid to the diagnosis of forms of insanity.

In the *chronic form* of mania, where the condition of the brain differs from that of the acute form, in being in a state of chronic congestion with a liability to degeneration and softening, or formation of abscess, the ophthalmoscope seems also to be of some use.

I have examined one hundred and seven cases of this affection, and found forty-one of them perfectly healthy in both eyes, whilst three had pallor of the disks. The other sixty-three showed different stages of congested or inflamed disks, among them ten well-marked cases of choked or engorged disk, and three of neuritis. One man who was examined during a paroxysm of mania (a chronic maniac of ten years), instead of the staring, swollen white disks, which I observed in the paroxysm



of acute mania, showed a very red disk covered with minute blood vessels. What the intra-cranial change was that produced "neuritis" in the three cases in which I found this appearance, I can not exactly say; but as they were cases of double neuritis, I should suspect some cerebritis or chronic basilar meningitis involving the optic nerve. The cases of "choked disk," due to venous arrest, were no doubt caused by some adventitious product forming within the brain, or by sub-arachnoid serous effusion; and I have no doubt that later on other symptoms will declare themselves to corroborate this view.

*Melancholia.*—In acute and chronic melancholia we find anæmia of the central lobes of both hemispheres, and the rest of the brain in a comparatively healthy condition, the difference between the acute and chronic forms being that, though both begin alike, in the latter (called chronic only because of its longer duration) the organic changes of degeneration and atrophy of the brain cells begin. I examined twenty-four acute and twenty-three chronic cases. Of the acute cases nine were healthy, two had pallor of both disks, one a pale disk in the left eye and passive hyperæmia in the right, seven had passive hyperæmia with very small arteries in both eyes, one, disks dotted with red dots, and four had inflamed disks, two of them tending rather to ischæmia of the disks.

Of the twenty-three chronic cases seven were healthy, eight had passive hyperæmia of disks and retina, two had disks dotted with red spots, two had passive hyperæmia of the right disk and the left one normal, two had inflamed disks, and one, a very interesting case, had passive hyperæmia in the right eye and choked disk in the left. This was a case of mental alienation with symptoms of melancholia from an injury to the frontal bone just anterior to the coronal suture on the left side. He had also aphasia and defective vision of the left eye.

I was not able to get the history of the patient clearly enough to give his condition immediately after the injury. I saw him first a year afterwards, and he was then recovering from his aphasia, although speech was still defective. In all probability an ophthalmoscopic examination just after the injury would have given negative results, and I think the change in the disks

came on gradually, the "choking" of the left disk being due to a clot which produced this effect in its capacity as a foreign body. I have noted one case among the acute and two among the chronic with disks dotted all over with minute blood-red spots. I do not know what condition of brain this indicates, and only refer to it again to say that I have noticed the same appearance quite frequently in cases of alcoholism.

In my investigations with the ophthalmoscope among the insane, I am thus far satisfied with the results, and they are sufficiently encouraging to lead me to expect much more from the instrument as an aid to the diagnosis of mental alienation. I have tabulated the results of my work up to this time, though the number of cases is as yet too small to be of any statistical value. I shall, however, add to them from time to time until the number is large enough to serve as valuable statistics for reference. Meanwhile, I should be very thankful to any of my professional colleagues who would put it in my way to examine cases of known or suspected intra-cranial or mental disease of any kind, and when possible to corroborate the observations made by seeing the post-mortem condition.

#### ADDENDUM.

As an addendum to the paper I have presented on the "Ophthalmoscope as a Means of Diagnosis in Cerebral and Mental Diseases," some of my colleagues here present have requested me to give them the ophthalmoscopic appearances in the dead and dying, and have asked whether these appearances can be of any value in cases of doubtful death.

In answer to this I simply quote, as far as I can remember them, the results of a few examinations made, I think, by Dr. Aldridge:

In one case of general paralysis, ten minutes after death, the retina in each eye was pale, the optic disk white and atrophied, with no vessels on its surface. The veins, however, could be seen after leaving the disk, but presented a beaded appearance.

In a second case, one of bronchitis with chronic disorganization of the brain, the first examination was made whilst the patient was in a dying condition. The disk was then well defined, of normal color, with full veins and rather small arteries.

Eight or ten minutes after death the examination was repeated, and the disk was found to be perfectly white, with only one vein, the central venous trunk, which did not reach to the margin, though the branches were still seen on the retina, and had a beaded appearance; i. e., here and there the vein seemed empty. The arteries were not visible on the disk at all, being empty to its margin, but from there on to the retina they could still be made out very small and attenuated. Twenty minutes after death not an artery could be discovered, and six hours after, the retina had become yellow from the action of light.

A third case, when dying, had the pupils dilated with atropine, and the disk was found of a pale pink tint with small arteries and normal veins; but eight minutes after death the disk was dead white, the veins full, and the arteries began at some distance from the disk's margin; six hours after, the arteries had entirely disappeared, though the veins were still plainly visible and the fundus was yellow.

In a fourth case that had died of pneumonia, the disk was very white, the veins still full, and the arteries very indistinct; a few moments after death, and in six hours, the fundus was yellow, and no arteries could be seen.

Other cases are recorded, but all resembling more or less closely the foregoing. Here, then, we see that some hours (six or eight) after death the disk was white, the fundus yellowish, the arteries had disappeared, and the veins become beaded; i. e., irregular clots here and there in otherwise empty vessels. Therefore, the post-mortem retinal changes follow this order:

1st. The capillary pink tint of the disk gives way.

2d. The arteries empty themselves in the direction of their current.

3d. The veins empty themselves also in the direction of their current, but not completely.

4th. The red retinal tint of the fundus is bleached to a yellow color, this change being attributed to the action of light.

It may be objected that the disappearance of the capillary tint of the disk before the arteries empty themselves is an irregular proceeding, if we suppose the disk dependent upon the retinal and choroidal vessels for its nutrition; but, adopting



Galazowski's theory of the independent circulation of the optic nerve and disk (already given in detail), there would be no abnormality in such a result; and, in fact, this very post-mortem change goes a long way to support his views.

The usual signs of death, cessation of respiration and circulation, absence of sense and motion, facies hypocratica, the extinction of animal heat and cadaveric rigidity, are generally satisfactory; but all these may deceive, we well know, as people have been buried alive, a fact occasionally and unfortunately well demonstrated. Therefore, in cases where a doubt could be entertained, the ophthalmoscope might be of service in satisfying such doubt.

Possibly by close attention to its use in this field by accurate observers, the ophthalmoscopic appearances at different times after death might be recorded and made valuable in determining *how long* a person has been dead. In this regard it would be especially valuable from a medico-legal point of view in deciding the sometimes vexed question of survivorship in one of two persons to an estate depending upon such decision.



